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CONTRIBUTIONS TO THE STUDY OF THE AFFECTIVE PROCESSES[1]

By TAIZO NAKASHIMA

The writer's interest in the psychology of the affective processes dates from the year 1896, when he read Wundt's *Grundriss der Psychologie*, and in conjunction with Professor Motora began a translation of that work into the Japanese language. Hence, when opportunity arrived for the undertaking of advanced work, in the laboratories of Harvard and Cornell Universities, he naturally chose the feelings as a subject of special research. The experimental results obtained in the Harvard laboratory, under the direction of Professor Münsterberg, will be published in another place. The present paper gives the results of three investigations pursued in the Cornell laboratory during the years 1907-1909.

It is to be said at the outset that these investigations have not been made upon any systematic plan. In the present state of affective psychology, no such plan is possible, save to those who adopt the attitude and theories of a particular school. The writer entered upon them with an open mind, and believes that he has impartially recorded their outcome. He has simply sought to experiment at points where experimentation appeared feasible and desirable. So far as space allowed, he has given the observers' judgments and reports in their own words. Nevertheless it may quite well be the case that his interpretation and conclusions seem to the reader to lay undue

[1] From the Psychological Laboratory of Cornell University.

emphasis here and to show undue neglect there. The handling of a large body of introspective material, obtained in experiments that continued for several months, is at best a difficult task; and there is something misleading in the printed account, even if it is objectively correct, since all the sentences stand out at the same level, without the shading and subordination that appear in the spoken reports. Hence the writer desires to say here, at the very beginning, that no interpretation or conclusion is offered in the following pages that is not acceptable to the observers themselves. Wherever there was doubt as to the meaning of a report, the observer was consulted, and was asked to supplement or explain.

The paper falls into four parts: I. a study of the mechanism of the affective judgment; II. a study of the *Reizmethode;* III. an account of incidental results, bearing upon current affective problems, which were obtained in the course of the preceding studies; and IV. a study of affective process by the method of the discriminative reaction.

I. The Affective Judgment

When an observer, in work done by means of some one of the regular metric methods of psychophysics, makes a record of 'like' or 'different', 'present' or 'absent', we say that he has passed a sensory judgment. When the observer makes this record in work upon the affective processes, we say that he has passed an affective judgment. The phrases are parallel, and suggest an identity, or at any rate a similarity, of mental mechanism. Nevertheless, our knowledge of the two sorts of judgment is very different. Stumpf, for instance, bases his whole psychophysical theory upon the fact of the universality of the sensory judgment, and defines psychophysics itself as the concluding chapter of a "quantitative science of judgment".[1] Whether or not we accept this view, we cannot doubt that the position is tenable and arguable; enough is known of the sensory judgment to make its facts available for theory. On the other hand, our knowledge of the affective judgment is practically *nil.* Scattered hints towards its psychology may be found in the various investigations carried out by the method of impression. But no one appears to have asked, or to have sought experimentally to answer, the question: What precisely goes on in consciousness when I judge 'pleasant', 'indifferent', 'unpleasant', or 'more (less) pleasant', 'more (less) unpleasant'?

There are, of course, many cases in which this question is rendered nugatory by the writer's general conception of affective process. If affective tone or algedonic tone is merely an

[1] C. Stumpf: *Tonpsychologie*, i, 1883, §§ 1-7; Titchener, *Exper. Psychol.*, II, ii, 1905, clxi ff.

attribute of sensation, co-ordinate with intensity and quality, then the affective judgment is a sensory judgment akin to that of 'louder' or 'fainter', 'blue' or 'red'. If affection is itself sensation, organic sensation or centrally excited concomitant sensation, then again the affective judgment is a sensory judgment, akin to judgments of kinæsthesis or of synæsthesis. The former hypothesis, however, may be summarily dismissed; it cannot be seriously maintained, in the present state of psychology, that feeling is an attribute of sensation. The latter hypothesis is now on trial, in various forms, and has been accepted by many psychologists of standing. But there are at least as many, of equal standing, who assert the independence of affection as an elementary mental process. We cannot, therefore, assume without examination that a study of the affective judgment is superfluous, or identify that judgment outright with sensory judgment.

Experiments with Tones

Of the three principal forms of the method of impression, the serial method, the method of single stimulus, and the method of paired comparisons, the last was chosen in the present experiment as the method of procedure. As regards the selection and duration of stimuli, the interval between observations, and general experimental conditions, Titchener's method in his harmonical experiment was repeated as closely as possible, except in a few points where differences were necessitated by the divergent aim of the present investigation. The reasons for repeating these experimental conditions are as follow. Titchener's article in the Wundt *Festschrift*[1] contains definite indications as to the nature of the affective judgment, and Hayes' study[2] by the same method strongly confirms Titchener's conclusions. But these indications were brought out by way of evidence for the dual theory, as against Wundt's tridimensional theory, of affective process. Hence, although the two papers in question contain many suggestions with regard to the nature of affective judgment, and although the conclusions are based upon careful introspective records, yet the results are in so far indirect as that they were obtained incidentally, in the course of work upon a wider problem, the problem of the number of elementary affective qualities. On this account it is important to repeat Titchener's and Hayes' experiments, and to confirm or to refute their conclusions.

Another and, from the standpoint of systematic psychology,

[1]Titchener: *Ein Versuch, die Methode der paarweisen Vergleichung auf die verschiedenen Gefühlsrichtungen anzuwenden*, Philos. Studien, XX, 1902, 382 ff.

[2]Hayes: *A Study of the Affective Qualities*, *Amer. Journ. Psychol.*, XVII, 1906, 358 ff.

a still more important reason for the repetition of these experiments lies in the fact that the nature of their 'subjective evidence' suggests the existence of simple, elementary affective processes, and tells against the view that makes feeling a resultant or mediated experience. Again, however, the introspective indications do not demonstrate the independent existence of an affective element, nor did the authors directly approach this problem.

There can, then, be no doubt that we have here a definite point of departure for a further experimental study of the affective problem. It remains to decide how, in detail, the method of paired comparisons shall be applied.

Titchener applied his method to two of the three Wundtian dimensions; while Hayes, for sufficient reasons, extended it, and attempted to take into account, for one and the same set of stimuli, all three of the affective dimensions. In the present study, the observers were required to pass judgment only in terms of pleasantness and unpleasantness (P-U), except when the affective reaction was 'doubtful'. This limitation is justified by the considerations: (1) that while no one denies the validity of P-U as an affective dimension,[1] all other dimen-

[1] In the *Journal of Philos. Psychol. and Sci. Meth.*, iv, 1907, 190, C. H. Johnston remarks that "it is not quite accurate to say that 'no one denies the validity of P-U as a feeling dimension'". He cites the work of C. Minnemann, Atmung und Puls bei aktuellen Affekten (Martius' *Beiträge*, i, 4, 1905, 514 ff.), asserting that the author "is inclined to give up the P-U hypothesis as not serviceable, in that there are found for them [*i. e.*, for P and U] no distinguishing characteristic physiological symptoms". The reader will not find this statement in Minnemann. This writer is discussing emotions, not simple feelings; and he is examining them in the light of their expression in pulse and breathing. What he says is that, if you set to work to classify emotions in the light of physiological *Affektbilder*, you will not get much beyond the old division into sthenic and asthenic states. Johnston is probably quoting a remark made, not by Minnemann, but by Martius (*ibid.*, 512), to the effect that "festzustehen scheint auch, dass Lust und Unlust in keiner Weise bestimmte Symptomenkomplexe besitzen, durch welche sie sich voneinander unterscheiden". But this fact, if fact it be, has nothing to do with the validity of P-U as an affective dimension. Johnston further says that "Royce . . . finds many affective states which do not exhibit the P-U dimension". So he does, and so does Wundt; but neither denies the existence of the P-U feelings; see Royce, *Outlines of Psychol.*, 1903, 178. To maintain that P-U is an affective dimension is not to maintain that all affections are necessarily comprised within that dimension; and, similarly, to maintain that some feelings are feelings neither of P nor of U is not to maintain that P and U are not feelings. "It will be recalled further," says Johnston, "that for Binet also the fundamental feeling opposition is not of the P-U type, but rather of the nature of an activity-repose dimension." If the reference is to the work of Binet and Courtier, in *Année psychol.*, iii, 1897, 65 ff., it is no more relevant than that to Minnemann. The *Affektbilder* are, again, dependent rather on the intensity than on the quality of the emotion; but the writers speak, without hesitation, of emotions and ideas that

sions are matters of dispute, and (2) that our immediate problem is not that of the number of the affective qualities, but that of the determination of the nature of the affective judgment.

The method employed, therefore, is the same as that described by Titchener and Hayes, save for the limitation just stated, and for one important and a few minor differences, to be mentioned below. The same harmonical and noiseless pendulum, marking seconds, were used. The 24 tones in the three octaves *C-c* (64-128vs.), c^1-c^2 (256-512vs.), c^3-c^4 (1,024-2,048vs.) were combined in all possible ways, thus giving a series of 276 pairs of tones. The series was first formed by chance, and then so rearranged that the same tone should never occur in two successive pairs. Which tone of a pair should be given first was also determined by chance. In the earlier studies, this series was given 12 times to each observer; 6 times upward (lower tone first), and 6 times downward (upper tone first); so that there was a total of 3,312 experiments for each observer, exclusive of 'Make-up' experiments. In the present experiment, the series was not repeated, and only the total number of 276 pairs of tones was given to each observer. Number of experiments was here less important than full and accurate observation, since we were to make no appeal to the 'curves' which present in quantitative form the course of the affective judgment, but had introspective analysis as our primary object. The whole series of 276 pairs was given in precisely the same order to both observers. In most experiments, the two observed together sitting with their backs to the harmonical, about 2 meters from it, with a screen between them. The experiments were made at weekly intervals during the months of November, December, 1907, and January, 1908;[1] the hour, 2-3 P. M., was kept constant. The observers were instructed to judge of the relative pleasantness of the tones in the pairs sounded. They were told to listen to each tone separately, and to analyze their judgments introspectively, as fully and accurately as possible; especially they were to note the basis, motives, cues, in short, the means by which these judgments were or seemed to be effected. After ten pairs of tones had been presented, the observers began to write down their introspections; no limit of time was set, but in general a period of ten to fifteen minutes was found sufficient. The experimenter had intended to allow five minutes for rest as near the middle of the hour as the work permitted, but the observers

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are 'gaies' and 'tristes'. Finally, Johnston refers to Mach; but see *Analyse der Empfindungen*, 1900, 14!

[1] The interval of a full week was chosen with a view to the avoidance of any possible habituation, of which, we may here say, there was not the slightest trace throughout the experiments.

declared that this interruption was unnecessary, and for the most part continued throughout the hour without any relaxation.

The actual procedure of an experiment is as follows. The experimenter stands before the harmonical with one foot upon the raised pedal, the paper containing the series of the tones in his left hand, the pendulum bob in his right. At the signal "ready," he releases the bob and presses down the first note to be sounded. After two full swings of the bob (2 seconds), he treads once quickly and once slowly upon the pedal, and keeps a strong, even tone sounding for two swings of the bob. Then, after two seconds of silence, the second tone is sounded for two seconds in the same way. An interval of from 2 to 6 seconds is allowed, between the pairs of tones, for the recording of the judgment. After the 141st pair, this interval was increased to 30 sec., to allow of the writing of short notes upon important points of observation, and to prevent a possible lapse of memory during the remainder of the ten comparisons. This arrangement was continued until the 171st pair, when the observers decided that the interval was unnecessarily long, and the time was accordingly reduced to 15 seconds for the rest of the series.

The occasional unevenness in the intensity of the tones, the noises from the mechanism of the organ, the occasional creaks of the pedal in certain kinds of weather, noises within and without the building, the peculiar character of a few tones (c was apt to sound suddenly and at high intensity; b^3 and c^4 were rather faint; c^3 now and again developed a tremolo)—these disturbances and variations in the stimuli were of no material consequences for our problem. Moreover, the high degree of training of the observers showed itself in the rapid development of power of concentration, and in the complete ignoring of the disturbing factors. We were, therefore, not obliged to repeat in 'Make-up' series the occasional tests into which these disturbances and variations entered.

The results of the experiment are embodied in the introspective records of the observers. G's records are presented below in their entirety, so that any possible arbitrariness of quotation and conclusion is out of the question. Insight and accuracy are individually different, and the same materials may admit of different conclusions. But the introspective records here quoted stand for the facts observed, and represent the actual reaction of the observer. Observer G is Mr. L. R. Geissler, assistant in the psychological laboratory. G had had 3 years experience in experimental work, and had already taken part in extended affective studies. He is musical.

Introspective record I. 1st to 10th pair

1 (a^3-e^3) first Judgment usually very difficult. There was hardly

2	(c-c^4)	first	any inherent affective tone in the stimulus. Judg-
3	(a^3-a^1)	second	ment was arrived at by reasoning about the differ-
4	(d^3-d^1)	second	ent attributes of the two tones; for instance, the
5	(g^1-D)	second	one tone was smoother, more evenly blown (in-
6	(B-e^3)	first	tensively). The highest tones usually call forth
7	(E-g^1)	second	a frowning and twitching in the eye-lids. I am
8	(C-g^3)	first	afraid I am not yet in the right mood; I am some-
9	(F-g^1)	first	what constrained in my bodily attitude.
10	(e^3-f^3)	second	

In the above record, the figures in the first vertical row indicate the number of the pair sounded for comparison, while the word 'first' or 'second' in the third row indicates the observer's judgment that the first or the second tone of the pair was the more pleasant. In the remaining records, these data are omitted.

Record II. 11th to 20th pair

This series was rather irregular because of disturbances. I never could get into a truly affective mood. My judgments were still made intellectually, by deciding on the different attributes of each tone.

Record III. 21st to 30th pair

Closed my eyes, took the most comfortable bodily position, and let myself go entirely. Kept all foreign ideas out of my mind, and tried to keep myself in a perfectly constant and unchanged mental and bodily attitude. Now whichever of the two tones was more confirming in this, or whichever was less disturbing, was felt as the more pleasant.

Record IV. 31st to 40th pair

Was more difficult than last time to get into an entirely restful, quiet attitude. Consciousness was several times disturbed by external noises and ideas associated with them. Otherwise, I tried to make judgments on the same basis as before. Of my body I seemed to be unconscious altogether. The tone which disturbed me the less by fewer parallel other sensations and associated ideas was called the more pleasant. The tone whose qualities could easily be analyzed or forced themselves singly into focus was unpleasant.

Record V. 41st to 50th pair

In these cases the pleasantness was usually decided on the basis of some quality in the two tones. I was not yet able to get into the right mood. Associations aroused by the tones also sometimes decided the affective judgment. There seems to have been an entire absence of organic sensations, as far as I remember; *i. e.*, the judgment must have been based only on the external stimulus.

Record VI. 51st to 60th pair

I am at a loss to say why I liked the one tone better than the other. I know I am somewhat biased in favor of the lower tones anyhow, but I try to neglect this. My judgments are the conclusions drawn from an intellectual comparison of the different qualities in the two tones, the tone which comes nearer to a pure tone being called more pleasant. But I am unable to discover a purely affective elementary process in my consciousness.

Record VII. 61st to 70th pair

Tried to let tones make their impression without writing down the judgment, but found that I could not get much, because the tones did not have much affective quality in them, and associated ideas tried

to take the place of the affective judgment; only two or three pairs seemed to have something essentially different in the affective coloring of their respective members. But this shows that compulsory affective judgment is artificial.

Record VIII. 71st to 80th pair

Was still trying to quiet down after a fast walk; the lower tones were more quieting and soothing than the higher, and therefore more pleasant. By more quieting I mean that they seem to have a slowing effect upon breathing (and perhaps on pulse as felt in temples).

Record IX. 81st to 90th pair

Much more difficult to judge this time. Decided mainly by the qualities of roughness or smoothness in tones. I am not sure whether the lower tones are not more conducive to my general mood of quiet phlegmaticism. The lower tones do not disturb my organic equilibrium, do not seem to call for any kind of conscious muscular readjustment, while the higher tones do, sometimes very distinctly so.

Record X. 91st to 100th pair

I don't know whether there was anything peculiar in the different octaves. I know the tones made very little impression upon me one way or another; they hardly changed my general mood, and I simply judged them more pleasant by the presence of greater smoothness.

Record XI. 101st to 110th pair

Most notes were hardly pleasant at all, only in so far as my general mood was not disturbed by them. Only the very high tones are less pleasant distinctly, and always cause an involuntary frown. Occasionally I noticed my breathing and thought it rather deeper and longer than commonly.

Record XII. 111th to 120th pair

I was somewhat distracted by various things, and my mood was not very constant. The judgment was made more or less on the basis of secondary qualities in the tones; *i. e.*, they are logical constructions rather than indications of feelings. The whole situation as such was not very pleasant; there was much anxiety about the unsuccessfulness. This anxiety seemed to be an irregular flow of ideas, sometimes smoother and easier than at other times.

Record XIII. 121st to 130th pair

This time the general mood was better, almost indifferent, and the tones that disturbed it less were judged more pleasant. For the first time I noticed a mass of organic sensations trying to claim my attention, especially in the intervals between the pairs. I cannot say whether these organic sensations had anything to do with the general mood or the various feelings in particular; I simply noticed their presence.

Record XIV. 131st to 140th pair

The tones were more indifferent than ever before; even the highest ones no longer cause any great affective disturbance of the general mood. I had to guard myself against perfunctory judgments and asked myself again and again: Which tone do I actually like the better?

Record XV. 141st to 150th pair

My general mood of undisturbed indifference was very little or sometimes not at all changed by the various tones. The judgments were made on an inferential basis. Sometimes a few organic changes were noticed, but they did not seem to influence or be influenced by the general mood or even the tones.

Record XVI. 151st to 160th pair

The long intervals between the pairs (30 sec.) allowed me to fall into a kind of sleepy drowsy mood of a distinctly pleasant character. Now whichever of the two tones disturbed this mood more was judged more unpleasant. Some tones seemed to be surprisingly different either as to loudness or smoothness or both, and thus their affective tone was more easily determined by the greater surprise which they set up and which was unpleasant. Also the momentary awakening and writing down of the judgments was more or less unpleasant.

Record XVII. 161st to 170th pair

The situation was very similar to the one before. I find my previous observations confirmed, and merely tried to rule out the element of surprise as far as possible. I noticed also that the more unpleasant tones sometimes evoke a tendency to some facial muscular reactions, but only once did I feel an actual frowning, perhaps because my attention was not especially concentrated on this element.

Record XVIII. 171st to 180th pair

The only way I seem to be able to judge real pleasantness and unpleasantness is to let myself go entirely, to become passive, and to remain in a very constant, even half-sleepy mood and observe which of the two tones arouses me more or less to a normal state and which leaves me in the same mood as before. The tone which leaves me in the drowsy mood or disturbs me less in it, is the more pleasant. The tone which brings me back to a more normal mood of everyday life is more unpleasant.

Record XIX. 181st to 190th pair

Somewhat similar to last series, although the mood was not so phlegmatic and drowsy. I cannot remember that any organic sensations disturbed me or came into notice at all. The general feeling of indifference seems indescribable. The judgments arouse sometimes ideational associations, but these come rather after the figure [indicating judgment] is written down. Sometimes also, after the writing, I catch myself reflecting on other qualities of the tones compared.

Record XX. 191st to 200th pair

This time my attention seemed more labile; several times I found myself thinking of other topics. Hence the tonal judgments were made entirely on the affective basis. Only once I was doubtful, and began to reflect on the other qualities of the two tones compared. Toward the last the question occurred to me: Which of the two tones would disturb me less, or to which of them could I adapt myself more perfectly and more easily? The answer coincided with the more pleasant tone.

Record XXI. 201st to 210th pair

It seemed much easier to make the judgments, except in the doubtful cases. My attention was more concentrated than before, and ideational associations were easily kept out. My general mood was an easy let-go feeling; no organic or other sensations disturbed me.

Record XXII. 211th to 220th pair

Was less restful than before, also disturbed by wandering attention. But most of the judgments were easily made; perhaps because there was a great difference in pitch between the tones in the pairs.

Record XXIII. 221st to 230th pair

I have not yet got into a really comfortable mood of indifference,

and it was harder for me to make the judgments than before. Still I think I made them in the same fashion as before, letting myself go, giving myself up to the tonal pair and letting myself be affected by them, either the one way or the other. Once or twice I noticed with very high tones a strain in the right tympanic membrane.

Record XXIV. 231st to 240th pair

This time it was easier for me to make my judgments. Nor was I bothered by organic sensations. I just feel comfortable, and if a tone does not disturb me in this feeling I call the tone more pleasant. I don't remember any associated ideas or trains of thought; I was simply passively listening.

Record XXV. 241st to 250th pair

The situation was much as before. There is hardly anything to add. Twice, after the judgment was made, it occurred to me that I have heard the same tonal interval once before to-day, but this consideration did not influence my judgment.

Record XXVI. 251st to 260th pair

My general mood was not quite so stable this time. The noise outside from the wind seemed to make me feel somewhat restless. Nevertheless, I tried to be as calm as possible, and to make my judgments purely on the tones themselves, abstracting from the noises.

Record XXVII. 261st to 268th pair

Was very much less disturbed this time. Do not remember having heard the wind. Hence judgments were made more easily. My mood was quite restful and calm, and neither organic sensations nor trains of ideas were noticed.

Record XXVIII. 269th to 276th pair

Much the same as before. Only toward the very end it occurred to me that these were the last judgments, and I felt somewhat anxious about whether I had completely analyzed the situation or not. But when I look back I cannot find anything I left out, and I know now just as little as at the beginning why I like some tones better than others. It is just simply the way they affect me; and I imagine under other circumstances they would affect me quite differently.

We now proceed to an examination of the above introspective records.

I. In the case of this observer, the following five factors in, or determinants of, affective judgment may be distinguished.

(1) Reflection on the different attributes of the two tones. "Judgment was arrived at by reasoning about the different attributes of the two tones; for instance, the one tone was smoother, more evenly blown (intensively):" Record I. This factor is also mentioned in Records II, V, VI, IX, X, XV, XVI, XXII.

(2) General condition or mood. "Now whichever of the two tones was more confirming in this, or whichever was less disturbing, was felt as the more pleasant." Record III. "Which of the two tones would disturb me less, or to which of them could I adapt myself more perfectly and more easily? The answer coincided with the more pleasant tone." Record XX. This factor is referred to in all records, except VI and VII. In IV, VIII, XXII, XXIV, XXV, and XXVIII, the word 'mood' is not employed, but the operation of the factor is distinctly implied.

(3) Associations. "Associations aroused by the tones also some-

times decided the affective judgment:" Record V. See also Record VII.

(4) Bias or prejudice. "I am somewhat biased in favor of the lower tones anyhow:" Record VI. See also Record XIV.

(5) Breathing and pulse. "By more quieting I mean that they seem to have a slowing effect upon breathing (and perhaps on pulse as felt in temples)." Record VIII. Such facial expressions as frowning, twitching in the eyelids, etc., are also recorded, but are looked upon as concomitants only. And it should be noted that during the experiments of Record VIII, the observer was trying to quiet down after a fast walk.

II. Critical changes in the course of introspection. In accordance with his understanding of the instruction given, and in accordance also with his personal interest in discovering the basis of the affective judgment, the observer entered upon the experiments in a distinctly analytical attitude. He had often spoken in conversation of the 'inferential' nature of pleasantness and unpleasantness; and he now set systematically to work to find a 'reason' for the affective judgment. Such a 'reason' was first found in the different attributes of the two tones. In the first 20 comparisons, judgment was for the most part passed on this basis.

At the 21st comparison, however, the observer abandons this reflective attitude for an attitude that must be characterized as its direct opposite. The following quotations will show what is meant. "Closed my eyes, took the most comfortable bodily position, and let myself go entirely. Kept all foreign ideas out of my mind, and tried to keep myself in a perfectly constant and unchanged mental and bodily attitude" (Record III). "The only way I seem to be able to judge real pleasantness and unpleasantness is to let myself go entirely, to become passive, and to remain in a very constant, even half-sleepy mood" (Record XVIII). "My general mood was an easy let-go feeling; no organic or other sensations disturbed me" (Record XXI). The attitude is now that of passivity or receptivity; analysis and reflection have disappeared.

Under these conditions, the observer recognizes that the affective judgment is prompted directly by the external stimulus. "In these cases the pleasantness was usually decided on the basis of some quality in the two tones; there seems to have been an entire absence of organic sensations, as far as I remember" (Record V). It should be especially noticed that the records nowhere (save in the one doubtful case of Record VIII)) suggest the mediation of the affective judgment by organic sensations; see, *e.g.*, Records XIII, XV, XIX.

The search for a 'reason' has not, however, been given up. The observer is perplexed that the judgments attach thus directly to the stimulus, and mistrusts his observation: "I am at a loss to say why I liked one tone better than the other" (Record VI). He accordingly introduces a change in his method of observation: thinking that the explicit formulation of his judgment on the tones might lend an appearance of directness to the affective reaction, he now allows the tones to make their impression upon him without writing down a judgment at all. But the character of the judgment remains the same. Henceforth, therefore, the mood of passivity becomes the essential condition for the pure affective judgment, and the intellectual cues are relegated to a secondary place. Introspection furnishes the warrant. "The judgments arouse sometimes ideational associations, but these come rather *after the figure is written down.* Sometimes also, *after the writing*, I catch myself reflecting on other qualities of the tones compared" (Record XIX). And, this warrant once acknowl-

edged, the whole task becomes simpler and easier. "It seemed much easier to make the judgments, except in the doubtful cases" (Record XXI. There were 27 doubtful cases in the total number of 276 comparisons). "This time it was easier for me to make my judgments" (Record XXIV). Finally, the observer declares that "I know now just as little as at the beginning why I like some tones better than other. It is just simply the way they affect me" (Record XXVIII).

III. Conclusion.—It seems clear, from this examination of G's observations, that he passes his P-U judgments directly and immediately on the basis of the stimuli and of these only. The ideal conditions for the experiment are a mood of passivity or listlessness; an undisturbed bodily attitude and state; and freedom from intruding or distracting ideas when the series begins. There is apparently no mediation of the affective judgment by organic sensations.

G himself, unwilling at first to believe that the affective judgment is prompted directly by the stimulus, and confirmed in his scepticism by the nature of the instruction, attempts to find—almost one might say to manufacture—an intellectual basis for the judgment. He thinks that there must be a 'reason' for it over and above the mere quality of the tones. So he has recourse to 'smoothness', or to the 'tone which is nearer a pure tone', etc., varying his report in all sorts of ways, but always seeking for some intellectual construction of the affective judgment. That this search for a 'reason' is a search for what does not exist is clearly shown by the later introspections. G gives up his endeavor to find the 'reason', even while he would still like to find it, and is finally satisfied to take the stimuli as they come. He has tried various logical constructions (associations, organic sensations, power to distract, general disturbance of mood, etc.), and his efforts having been unsuccessful, he renounces the mediation of the affective judgment, and at once the "work is easier". Here, then, is an observer who at the beginning distrusts the immediacy of the affective judgment, and tries to argue himself out of it by all possible means; but whose own introspections, given by the way, convict him of immediate judgment as it were against his own will.

The second observer, Miss M. C. West, is graduate fellow in the department of psychology. Like G, she had already taken part in extended affective studies. W is also musical.

An examination of the introspective records of this observer seems to justify the distinction of two main classes of affective judgment: the associative and the direct. The direct judgments are again divisible as (1) judgments prompted by the tones themselves, with or without certain concomitant processes (especially organic sensations), and (2) judgments prompted by other motives than the tones.

I. The associative judgments

1. The tones were judged on the basis of their 'fitting in with the mood': they seemed to be what the observer wanted; she wanted to sing them; while in the tones themselves, as qualitative processes, there was nothing unpleasant, and nothing strikingly pleasant.

2. Certain middle tones were pleasant, because the observer had the same sense of ease (or absence of strain) and rest, in hearing them, that she would if she were trying to sing them.

3. Tones were unpleasant because agressive, forcing themselves on the observer, seeming not to fit in with or belong to the disposition of consciousness.

4. Tones were unpleasant because too loud or sudden, 'ruffling' the observer 'all up'. Or because harsh and rough, 'keeping her on edge'. Or, again, because nasal and twanging. In all these cases associations were set up, along with the obvious arousal of organic sensations. "The ominous association with the sound in some of those lower notes seems to make them more distasteful than even very shrill, thin high notes that I usually dislike most" (Record III). "The first tone in the pair 75 had an arousing effect through the association of a trumpet call that was solemn in nature and therefore unpleasant" (Record XVIII). "I am pretty sure that the gruffness and roughness of some lower notes may be unpleasant partly through associations with hoarseness and with people of rough low tones in speech, who are often cross and disagreeable people" (Record XXV). "Some of the deep rough tones were judged so not by strains but by a sort of mood they threw me in, of depression and fear" (Record IX). "Many of the notes are judged pleasant or unpleasant by associations, I think, such as Christmas horns, whining animals and people, roaring lions, etc., according to the associated mood these objects set up" (Record XIII). "None but sweet notes seem pleasant to me unless because of associated mood" (Record XVIII).

II. The direct judgments prompted by tones

The nature of these judgments will be clearly seen from the following quotations. "I don't know by what means I judged that I liked it. Maybe I thought 'clear, full, sweet,' maybe I thought of flute notes; but I don't think I did. Maybe I judged by the absence of things that made me shrink" (Record IX). "The high notes seem unpleasant in themselves, but it may be only that the unpleasant strains are more local, in the region of the ear. I can't make out whether the unpleasantness is the strains or not" (Record VI). "The unpleasantness seems to come in at once. There is a kind of jarring which is unpleasant, though I don't think I call it that; I could as easily call it jarring as unpleasant, but I don't think I call it anything. It is just a feeling that I can't sit still and listen to it" (Record VI). "They seem unpleasant from the first, and I can find no word or judgment in consciousness. I caught myself making a mental grunt" (Record VI). "Can't tell what made 71 [the first tone in the pair] pleasant or sweet" (Record XVIII). "I think some tones are pleasant and unpleasant to the ear itself, not counting strains around the ear or unpleasant vibrations, which are not always present even when the tone is unpleasant" (Record XX). "Some very high tones are unpleasant just because they are high, without being shrill or causing any particular associations" (Record XX). "The organic sensations in the case of pleasant tones seem to follow the affective judgment and do not seem to be its basis. They seem to create a desire for more, and a restlessness; their pleasantness is not created by this relaxation, etc." (Record XXV). "Caught myself saying 'don't like it,' but generally noticed a shrinking, wincing, turning of head away without any words or thought; but I can't tell whether those movements were the unpleasantness, or their sensations were the unpleasantness, or whether there was a distinct process of unpleasantness" (Record V). "There were three tones there that I just liked in themselves, and when I asked why, the words 'full, rich, sweet' came. It had something to do with the pitch being a medium one (not associated with the strain of high pitch), but it was more than that. They were accompanied by no perceptible organic sensations and no ideational associations. They seemed to satisfy, and a deep breath followed as a result. The ear lingered on them and tried to hold them and one

wished they would continue" (Record XXIII). "In the pair 262, there was not anything except the tone itself which was agreeable. I liked the tone. I am not even sure that it was full or resonant or had any of those associated attributes which might be a basis of judgment. I noticed that the nasal quality of both tones in the pair 264 [g^1 b^1] set up no detectable vibrations and strains and had no observable associations, but when I asked why unpleasant, I merely answered 'nasal.' It seemed as if the inharmoniousness of the tone itself were directly unpleasant to the ear drum. Nor was the roughness in the first tone [F] in the pair 266 [F-e] unpleasant because of associated hoarseness; but it seemed to have thickness and roughness, unpleasant just as the nasal tone was to the drum itself" (Record XXIII). "I tried to think what made 33 so pleasant to me but I could not. I think it put me in a pleasant mood but why, or why the mood was pleasant, I do not know. I know that relaxed organic sensations had something to do with it" (Record XIV). "1 in each case gave no disagreeable strain sensations and was in no distinguishable way otherwise unpleasant than by the gloomy mood it induced" (Record XV). "The very deep tone in 57 seemed to be judged disagreeable instantly from a general dislike of very deep tones, not because it was intrinsically very disagreeable" (Record XVI). "The judgment is nearly always made on the basis of degrees of unpleasantness. No tone seemed really pleasant. It was a matter of release from unpleasant. [c and g^3] in 61 and 62 were rather sweet, possibly because of no strain" (Record XVII).

III. The direct judgments prompted by other motives

The principal motives to judgment in this class were organic sensations of ear strain, nose tingling, tendency to shut ears, vibrations in head, nose, ear or chest, hitting or piercing of ear-drum or head, headwincing, etc. "The shrill notes that I did not like were sometimes judged so by ear strains that seemed to go down to my toes" (Record IX). "In some cases I judged it was unpleasant by means of strains, as in the pair 100, a high shrill tone that made my nose tingle and my eyes shut, and I did not like it because of the strain, I think. On the other hand there were twangy tones that were unpleasant because of something else, I don't think it was strain, but an unpleasant vibration set up somewhere in the head, nose or ears" (Record X). "One note seemed to pierce the ear drum and made me want to put my hands to my ears. My head distinctly winced. Other twangy tones set things vibrating around nose and ears, which was unpleasant. Other rough low tones caused a disagreeable vibration somewhere (could not localize it); seemed perhaps in the chest; it was unpleasant. In all these cases it seemed more the organic sensations that were unpleasant than the tones" (Record XI). "Very disagreeable to the ear, induced reflex of head, felt as if things were hitting the drum and piercing the head" (Record XV). "Sometimes the judgment is entirely based on organic sensations of strain and disagreeable vibrations in face and ear; sometimes apparently localized in drum, those seemed squeaky; sometimes across nose and face, those seemed twangy" (Record XVI). "Based largely on strains, contractions of muscles and ear and nose vibrations; sometimes in body (chest particularly) also" (Record XXII). The last quotation that we shall make shows a mixture of motives. "In every instance the unpleasantness seems to be derived from something else, organic sensations or a foreboding mood. It is possible that the pleasant tones also were judged so by comparison with a standard of clarity of tone which I considered beautiful and which was gained from opera

singers and from musical instruments. I think the absence of jarring organic sensations is one thing in the pleasantness of a tone. I don't know whether the rest is an inference according to some standard or not" (Record XII).

Conclusions from W's Observations

This observer is much more liable than G to organic sensations. And she has fallen into a rather natural mistake: she thinks that, if she can put her finger on some accompanying organic sensation, she has found a 'reason' or 'basis' for the affective judgment. But, of course, we have to ask how an organic sensation is judged pleasant or unpleasant, just exactly as we ask how a tone is thus judged. In fact, if we abstract from the cases of association, the affective judgment seems to be immediate (there were only five 'doubtful' cases out of the total number of 276 judgments). The immediacy is, however, of two kinds. The affection may attach (1) to the tone itself, without there being any assignable 'reason' for it to do so; it just belongs to the tone: or it may attach more prominently (2) to the organic reverberation set up by the tone. It is clear, indeed, that this observer wished to find a basis for judgments in organic sensations, just as G wished to find a basis in intellectual factors. She succeeds better than G, in the sense that she often finds the P-U judgment attaching to organic sensations set up by the tone, while G had no success with his logical reflection. But she offers no 'reason' for this attachment of P-U to organic sensations; so that really the judgment is as immediate as it is in the many instances in which the tones themselves are pleasant or unpleasant.

W's introspective records are not given here in full, since they are far more homogeneous than those of G, and offer no similar possibility of varying interpretation.

We have now to compare the general result, gained from the study of these introspective records, with the conclusions drawn by Titchener and Hayes, so far as these are relevant to our problem. "Judgments of P-U," these authors report, "were easy, direct and natural. It was exceptional to find any reason, any basis for these judgments: the stimuli were intrinsically pleasant and unpleasant, more pleasant or more unpleasant than their neighbors: and when a reason, or a basis was found, outside of intrinsic affective tone, it lay in the organic reaction set up by the stimulus employed."[1] So far as directness or immediacy of judgment is concerned, the outcome of the different investigations is strictly comparable. And even on the score of ease and naturalness there is some possibility of comparison. It is true that a judgment might be difficult, straining, and yet be immediate: that would be the case, *e.g.*, when the state or process to be judged lacked clearness, was faint or indefinite or fleeting. On the other hand, since it must be impossible to analyze, or to pass mediate judgment upon, a mental process which is in reality simple and ultimate, judg-

[1] Titchener: *Psychology of Feeling and Attention*, 1908, 165. Hayes: *A Study of the Affective Qualities*, *Amer. Journ. Psychol.*, 1906, 389.

ment under such circumstances will become unspeakably easier and more natural as soon as the attempt at analysis is given up. In this sense, ease and naturalness of judgment become a test of the simplicity of the process in question, and thus a test of the immediacy of judgment itself. The test is especially applicable to the situation in which the observer G found himself placed during the latter part of the experimental series reported above.

As regards the primary issue, of immediacy of judgment, the evidence of the earlier studies was, of course, not conclusive, and was not stated as conclusive. The spirit of the instruction given, and the mode of treating the observers' judgments (the procedure of 'make-up' series), may even be said to have put a premium upon the immediate affective judgment. The stimuli judged directly affective under these conditions might prove to be only indirectly affective under another form of instruction. Hence it was plainly necessary to supplement the earlier work, in which judgment was called for on the ground of the stimuli, by experiments in which the observer was required to introspect the affective judgment, with a view (if possible) to the discovery of its 'basis' or 'reason.' If the immediacy of the affective judgment is still attested, with this special direction of attention, then it may be regarded as established with some degree of certainty. But this is precisely the result to which we have been led. And it is a result, be it remembered, which is entirely opposed to the initial expectation of the two observers.

But, it may be urged, these observers speak in fact of several bases or reasons for their judgments, over and above the mere quality of the tones, and beside the organic reverberation set up by the stimuli. They appeal to various secondary attributes of the tones, such as their smoothness, purity, etc.; to general disturbances of mood; to associations; to a bias or prejudice of general like or dislike; to the sense of fitness; to the mood temporarily aroused by the stimulus; to some relation, of contrast or what not, to other affective or sense qualities; to motor tendencies, and to actual movements. That is true. It is, however, equally true that these bases or reasons are for the most part directly attributable to the interpretation put upon the instructions given, an interpretation dictated by the observers' personal interest in the explication of the mechanism of the affective judgment. The immediacy of that judgment is, nevertheless, plainly brought out, even against their inclination, and in spite of a reflective attitude that was unfavorable to any immediate experience. Had they passed their judgments, throughout the experiments, under the ideal con-

ditions of passivity and receptivity, practically all of these judgments would probably have been immediate.

We do not deny that there are cases in which an indifferent stimulus may be affectively judged by association, or in terms of some bias or prejudice. An indifferent impression may be judged affective through its relation to some other, vividly affective experience; a 'blunt meaningless tone', for instance, may become unpleasant by contrast (the term in its widest sense) with a 'full rich tone', the bluntness and meaninglessness being simply the result of association. Or again, the impression may be more or less affectively colored, intrinsically, and yet may be distinctly modified in its affective intensity or quality through bias or contrast or any other form of association. There are many cases, among these associative judgments, in which the observer cannot be sure whether or not there was any affection attaching to the stimulus as such, but is aware only of the affection attaching to the associated ideas. All these facts we admit. But we assert that, in general, these mediated judgments tend more and more to disappear as the experiments progress and the observers gain in practice. Associated ideas, permanent likes and dislikes, the 'sense' of fitness or congruity with the present contents of consciousness,—all these things are secondary criteria, which the observer at first, in his comparative helplessness, avails himself of, but which he learns to disregard as his familiarity with the problem in hand increases. The very same stimuli which are now judged by their associates are presently ranked in terms of their intrinsic pleasantness or unpleasantness. There can be no doubt of the immediacy of the affective judgment; there can, we think, be no doubt that the various experiences offered from time to time by our observers as the 'basis' or 'reason' of the affective judgment are of the nature of disturbing factors, that should so far as possible be eliminated from an experimental study of that judgment; precisely as, in psychophysical work, the influence of association and the admission of secondary criteria are ruled out by experimental arrangement and by the shaping of instructions. The tones are judged pleasant or unpleasant with the same directness with which they might be judged loud or faint.

Experiments with Colors

In the earlier studies of the affective tone of colors, the problem was the determination of preference, and its systematic expression in quantitative terms. Neither Cohn nor Major, for instance, gives us any definite information as regards the mediacy or immediacy of the affective judgment. Thus, Cohn says only:

"Der eine [Beobachter] wird rasch zugreifend entscheiden, der andere lange hin und her schwanken, das einmal gegebene Urtheil wieder zurückziehen und schliesslich zu keinem oder doch nur zu einem unsichern Resultat gelangen. Häufig hört man gerade im Anfang, dass die Sache doch wohl bekanntlich subjectiv und unsicher sei, dass man sich der Verwendungs-Associationen gar nicht erwehren könne und dergleichen mehr. Wenn man dann wieder und wieder hervorhebt, dass es sich ja hier nicht um eine Geschmacksprüfung handele, dass jedes Urtheil gleichwerthig sei, es möge nun ausfallen wie es wolle, dass es nur darauf ankomme, den augenblicklichen, unmittelbaren Gefühlseindruck wiederzugeben, so gewöhnt man seine Beobachter allmählich an ein ruhigeres Verhalten. Und diese gleichmässigere Gemüthslage ist ein unabweisbares Erforderniss zum Gelingen der Versuche. Handelt es sich doch bei denselben um einen ziemlich complicirten psychischen Process. Der Beobachter soll die ihm gebotenen Sinneseindrücke möglichst ohne Reflexion auf sich wirken lassen und er soll dann diesen rein gefühlsmässigen Vorgang in die intellectuelle Form eines Geschmacksurtheils kleiden. Es besteht also die Gefahr, dass jener intellectuelle Urtheilsvorgang gewissermassen vorweg genommen werde, dass der Beobachter sich Theorien mache und unbewusst nach diesen sein Urtheil bilde."[1]

These sentences point out difficulties of method; they do not help us greatly to an understanding of the nature of the affective judgment. Major's notes, under the heading *The Affective Judgment*, practically coincide with those of Cohn. He noticed the tendency to theorize, to put reflection in the place of direct experiencing; and the difficulty of obtaining a 'gleichmässige Gemüthslage' from his observers, due partly to the confusion of the æsthetic with the affective judgment, the conviction of the 'subjectivity' and uncertainty of the experiment, etc., and partly to the unaccustomedness of the required judgment. He also noticed the influence of mood. Major's observers sent all impressions alike up towards pleasantness when they were in 'good spirits', working on a pleasant day after much wet weather, etc.[2] So Cohn's "vier verschiedene Beobachter erwähnten gelegentlich, dass sie dieses oder jenes Urtheil abgäben, wiel die betreffende Farbe oder Farbencombination ihrer augenblicklichen Stimmung besser entspräche. So wurde auch einmal ein Gleichheitsurtheil durch die Aeusserung motivirt: 'man würde je nach der Stimmung bald das eine bald das andere schöner finden; verschiedener Gefühlscharacter, darum sehr schwer zu entscheiden'. Ein Beobachter hob hervor, dass ihm bei guter Stimmung die Unterschiede viel deutlicher zum Bewusstsein gekommen seien, als bei schlechter".[3] For this reason, Cohn finally decided not to appeal to introspection. Indeed, both he and Major found it necessary to work towards mechanization of the judgment process during the experimental hour. They both noticed that the number of distracting associations decreased as the experiments progressed. But we are not informed whether or how the associations influenced the nature of judgment. Some of Cohn's observers, again, seemed to be influenced by the serial order of experimentation; a color or color combination might be judged pleasant simply because it was strikingly different from the preceding, unpleasant

[1] *Experimentelle Untersuchungen über die Gefühlsbetonung der Farben, Helligkeiten, und ihrer Combinationen*, Philos. Studien, X, 1894, 596-597.

[2] *On the Affective Tone of Simple Sense-Impressions*, *Am. Jour. Psy.*, VII, 1895, 61-62.

[3] *Op. cit.*, 598.

color. But this sort of influence may fundamentally change the nature of the judgment.

Our own experiments with colors, like those with tones, were planned solely with a view to the better understanding of the affective judgment. The experience gained in the harmonical experiments made it possible for us to put a series of definite questions to the observers,—who, however, were notified that they should by no means consider themselves bound by the order of the suggestions, nor feel obliged to state their observations on all points during every introspective interval, but that they should observe and report as opportunity arose, and supplement the questions set in any way that occurred to them. The method employed was again that of paired comparisons. The judgment was passed in terms of P and U; the observers reported which of the two stimuli was the more pleasant, or (if both were unpleasant) which was the more unpleasant. The 26 (Milton Bradley) colors employed were combined in all possible ways, thus giving a series of 325 pairs.

The whole series of 325 pairs was given in precisely the same order to both observers, who in these experiments observed separately, sitting at a distance of 1.5 m. from the windows (3x3 cm.) of the neutral gray exposure apparatus. The experiments were made during the months of January, February, and March, 1908. They were performed in ordinary diffuse daylight in the same room of the laboratory; every care was taken to keep the light as constant as possible, by the adjustment of white curtains at the windows of the room. The time of exposure of the colors was 5 sec.; the interval between observations, during which the observers recorded their judgments and could make short introspective notes, was 10 sec. After every 5 comparisons, they were required to write out full introspective reports, without any definite time limit. Miss West and Mr. Geissler again served as observers. We begin with an examination of W's records.

Of the total number of 325 judgments passed by W, 266 were immediate. W now terms these direct judgments 'affective' or 'purely affective.' They are all phrased in much the same way; the following may serve as illustrations. "I think the judgments were certainly purely affective; I could give no reasons why, and felt no organic sensations throughout these experiments, except consciousness of deep breathing when I liked the color and of movement away from the color I disliked." "Both colors in the pair are horrid to me; one perhaps less than the other because 'less like purply' I said, but I really think it was a purely affective judgment. 'Less purply' was no reason." "I hated the dark buff [in no. 40]. It is a color seldom or never seen and I had no prejudice against it or association with it; it was an affective judgment."

There were 35 mixed reports of the following kind, in which, never-

theless, immediately affective judgments appear to be comprised. "There was a distinct prejudice against the color at the right hand side, but also there was an immediate dislike of it." "I think there was a distinct prejudice from preceding judgments that I should like the pure yellow better than the orange; but perhaps I also liked it immediately." "In the third pair there were also intellectual judgments that the oranges were too bright, but I think an immediate judgment that the red was the more pleasant came first, and a feeling of irritation with the orange." "After deciding that I liked the pure yellow there came the thought 'but see how bright they are,' which though I think it modified my liking did not make me find the yellow unpleasant." "In no. 4 I immediately liked the greenish yellow and then I thought 'but is not that the ugly bilious green you do not like?' but it did not make me dislike it." "I had an image of robin's eggs with the blue green, which was almost inseparable from the color itself, and made me like it better than I would otherwise." "In 56 the thought of yellow satin dresses and yellow ribbons, and the good times I had had wearing them, made me like better the yellow which I think I liked anyway." "The yellow in 68 I did not like at first, but suddenly there came a vivid recollection of the sunshine on the wet grass in the picture of a French artist whom I like, which made me like this green and the greens in 69 and 70." "As the blue violet reappeared in 74 I could hardly make myself look at the other color to see whether I liked it or not. I forced myself to ask, why do I like it? and I answered 'soap bubbles' and then 'Frenchman's pictures of the Seine and The Tower of London'; but these associations came later and brought a new kind of pleasure, not so absorbing but more acute." "There are certain shades I noticed that I dub 'artistic', I don't know why. This may be an individual feeling that a dull color that I like is artistic. It may be some forgotten association. I believe the soft shades, the mixed shades, may usually be called art shades and the dark soft shades especially so. I should not call the buff artistic though I like it. But the dull green in 44 as well as the pea-soup color may derive its likableness partly from codes of art got from custom. Yet I think there is a strong immediate affective judgment there too, as there is in the buff which is not called artistic." "The contrast in 90 made both less pleasant than they would have been separately, made them seem too dark and too light." "The contrast in 95 made both worse. In spite of the prejudice in favor of dark colors, the color at the right in 94 though dark seemed horrid to me; I could not bear to look at it." "The contrast in 137 made both worse. I could not decide which I disliked more, could not make myself continue looking at them, eyes passed rapidly back and forth and then fell." "I seem to have certain codes already established as to what I do or do not like in colors; I know I like dull colors and a blue violet. Yet I think that these decisions were made on a purely affective basis."

The remaining 24 judgments were, perhaps, more definitely associative in character. "These judgments were all mediate, and the associations of eggs and grass rendered it difficult to decide which I liked of the two in 21." "Usually the judgment is instantly made, perhaps largely by prejudices which may have been affective judgments at first or may have been determined by convention and usage. These prejudices are very decided and act at once and without hesitation." "There was a distinct association of biliousness and caterpillar juice with that yellowish green which made me reject it, without liking the alternative color especially. The bright greens and yellows seemed too crude, but the mixed green and yellow was nasty (whether it

was unpleasant in itself I cannot say), and I don't think the associations crowded up with the yellow green; only I had evidently decided that that color was nasty and repulsive from its associated objects." "But these affective judgments have settled into such codes that the judgment may not be purely affective any longer." "When I had up the preferred dull against the preferred brighter but bluer violet, the lack of affective elements came out more strongly; it seemed to be a matter of which judgment of liking did I cling to more tenaciously, dark colors, or blue violets." "I think I do have an initial attitude of readiness to embrace or to be repulsed by the color. I think this attitude is followed by a movement toward or away from the color."

It seems fair to conclude that the affective judgments of color impressions are or may be immediate; the great majority of W's judgments were, as a matter of fact, passed without any mediation.

W states that her attitude in observation may be that of active attention, in which event she uses the terms "like and dislike", or that of passivity and receptivity, in which event the terms "pleasant and unpleasant" suit better. She says also that it may make a difference, not only in the ease and rapidity of judgment, but also in the judgment itself, whether the attitude is active or passive. "Most of these decisions are made instantly and with no trouble whatever in both the active and passive state, but when a difficult decision has to be made it is much harder and slower if the mind be passive. I think that more associations come with the passive state, but I am not sure of this. When pale blue and yellow were compared I liked the blue better in the passive state and the yellow better in the active. The blue caused me less excitation and was more pleasant. The yellow I liked better, and found more delightful if I took the trouble to enjoy it. There was not much I could do with the blue; it was just there."

The observer G at first assumed the reflective, analytical attitude of which we have already spoken; the result was that in the early stages of the experiment he often found very little to choose between the colors, and his judgments were frequently doubtful. However, he soon became convinced of the immediacy of the affective judgment, and thenceforward found it easy and prompt. Of his 325 comparisons, 272 were of the direct type. The following illustrations may suffice. "The greater pleasantness in nos. 16, 18, and 19 was quite pronounced. I felt really pleased by the colors as such; no secondary criterion seemed even to lurk in the background." "I had an idea that there would be many more doubtful cases than I have had so far. Usually, however, it was not difficult for me to decide. I noticed no bodily processes whatever, and cannot remember anything that entered consciousness during the attention to the colors." "It was not difficult for me to decide, but I am vexed if one asks me how and why I like one color better than another. I am sure in this series there were no associations, except perhaps that one chocolate-brown called up an image of the wrapping of Hershey's Chocolate. However this did not influence my judgment." "With one exception judgments seemed easy, immediate and unhesitating. Usually I had made my preference before the second signal came." "I believe I could reconstruct a great deal of the background of memory or reason or both, but don't have the faintest idea that this would help me in deciding why I liked one color better than another." "The pleasantness in these colors was not pronounced. Yet I had no difficulty in deciding which I liked better. There were no associated ideas, nor any verbal or visual images connected with the stimuli sometimes." "I am still at a loss to tell how I prefer and why I do so. The background processes of consciousness don't seem to have anything to do with it. The

two colors are in the focus of attention, the rest is almost unconscious." "The judgments came quickly and immediately, without interference of associated ideas or any other conscious processes." "The degrees of preference seem to be quite distinct to-day. Nevertheless the judgments are made immediately and without deliberation. It is only after the decision that I begin to make distinctions as to greater or lesser degrees of preference."

The remaining 53 judgments were of the following kind. "In no. 13 the right color was constructed or synthetized out of the left *plus* a little red, just enough to destroy the pure saturation of the right in comparison with the purer left color. The same consideration influenced also my next judgment, where the same color was to be compared with another." "I think I judged more the saturation. In this, however, my judgment was immediate. But at the beginning I could not avoid a short reference of the two colors to circumstances under which they had been seen before. Also in nos. 24 and 25 I judged more the saturation." "Again the purer colors were preferred. The third pair was distinctly judged by saturation." "The judgments were easily made simply on the basis of color-preference, no other criteria seemed to enter except in no. 219, where the left was rejected on account of its poor saturation." "The preference was quite easy, based on an immediate æsthetic pleasure derived from one color, sometimes on account of its shade, where saturations were about the same." "This was a plain preference of better saturations. Why I like them better I am unable to say." "In the very first comparison the judgment was not so much on the color as on the brightness. The suggestion of clear and dirty influenced the decision. In a less degree also the second pair was judged in this way. The real affective tone was very slight."

W, as we have just said, reports an oscillatiou of active and passive attention in the color work. G, who in the harmonical experiments insisted strongly on the advantages of the mood of passivity and receptivity, now reports, throughout the series, an active concentration of attention upon the stimuli as most favorable for the passing of the affective judgment. As a rule, he entirely failed to notice what was going on in the background of consciousness while he attended to the colors.

For G, there is no difference in the judgments expressed by 'pleasant' and 'like', 'unpleasant' and 'dislike'. Here we seem to be in presence of an individual difference between the observers. The general tendency to a passive reception of tones and an active attention to colors may be ascribed, with some confidence, to the different impressiveness or attention-compelling character of these stimuli. The tones are, without doubt, more striking, less escapable than the colored squares.

The results of these two sets of experiments appear to warrant the conclusion that affective judgments may be and usually are as direct and immediate as the sensory judgments of psychophysics.

II. The Method of Single Stimuli

The experiments which we are now to report were planned at the same time as those described above, but were made earlier, namely in the months of October to December, 1907. They are postponed to this place, since they lead on naturally

to the further experiments of Section IV, which were performed last of all.

Selected stimuli, twelve cutaneous and twelve olfactory, were presented to the observer in separate series, one at a time and in chance order, for 15, 10 or 5 sec. The method employed is thus that named by Brahn the *Reizmethode.*[1] Our object was, by fitting instruction to the observers, to secure reliable introspective data as to the nature of affective process and its difference from sensation. The stimuli were chosen with a view to their probable affective value, as well as with a view to their perceptual characters; and the observers were asked to take each one as it came, and to say what it did to consciousness,—to give their immediate conscious reaction upon it, without making an effort to identify or to analyze. We hoped that, if some of these reactions were definitely affective and some definitely perceptual, we should be able to appraise the various criteria of affection proposed by other investigators.

It may be said at once that the longer times of presentation of stimulus were rarely utilized by the observers. Only in the case of certain cutaneous stimuli, and in that of a few scents of extreme pleasantness or of unknown quality, was the limit of 15 sec. reached. The aim of the experiment was to secure the immediate conscious response to the stimulus, and in many instances this response was made in 1 sec. or even less. Hence the time was reduced from 15 to 10 sec., and in the latest series to 5 sec.

The cutaneous stimuli employed were (1) sandpaper, (2) heavy plush, (3) glass, (4) rough felt, (5) quicksilver lying in an enamel-ware pan, (6) rubber sheeting stretched over the mouth of a glass funnel, (7) fine sand spread in a flat wooden box, (8) smooth stretched leather, (9) a smooth brass plate heated to about 55° C., (10) ice water, (11) a blackboard eraser, and (12) polished hard wood. On the signal, the observer, seated at a table with closed eyes, made a pawing movement over the surface of the stimulus with the tip of the right forefinger. The olfactory stimuli, contained in similar glass bottles, were (1) carbolic acid, (2) mixed vanillin and cumarin, (3) benzole chloride, (4) listerine, (5) oil of anise, (6) sulphuric ether, (7) essence of peppermint, (8) valerianic acid, (9) violet water, (10) asafœtida, (11) nitro-benzole, and (12) musk. On the ready signal, the bottles were taken in the left hand, and at a 'now' were uncorked by the observer, raised to the nose, and inhaled. Here, as before, the observer had his eyes closed during the experiment; in no case was the

[1] M. Brahn: Experimentelle Beiträge zur Gefühlslehre, *Philos. Studien*, XVIII, 1903, 133. Titchener: *ibid.*, XX, 1902, 404.

introspective record influenced by sight of the stimulus. Every care was taken to avoid adaptation of the organ, or diffusion of an odor in the room in which the work was done.

The observers were Miss West and Mr. Geissler, of whom we have already spoken; Mr. W. H. Pyle (P), assistant in psychology; and Dr. Weber (Wb), a graduate of the University of Pennsylvania.

In their main purpose the experiments miscarried. Whether this miscarriage was the fault of the method itself, or of our selection or manipulation of stimuli, we do not know. We took every precaution that we could think of, and we naturally incline to blame the method. At any rate, what we got was not any clear-cut differentiation, on a positive basis, of affection and sensation, but rather a reflection of the theories and idiosyncrasies of our observers. Thus P entered upon the experiments with the idea that pleasantness and unpleasantness are attributes of sensation, and his introspective records are for the most part couched in terms of this opinion. W, as we have seen, has keen and varied experience of organic sensations; she began the work, not with any definite theory of the nature of affective process, but with the general expectation that it would turn out to be an organic complex; and organic sensations figure largely in her records. G was inclined to look upon affection, in Wundt's early manner, as something relational, perhaps even as the result of an unconscious judgment or inference. It is easily possible, in his as in W's case, to make the prepossession too explicit, to formulate expressly what was in reality only a sort of trend or tendency or line of least resistance; but it is at least safe to say that G's attitude was reflective, intellectually analytic, and not receptive. He was accordingly disposed to note whether the stimulus gave 'objective' knowledge, or whether it produced a 'feeling of change' in the sense-organ; whether it was accepted as informatory, or whether it aroused movement by attraction or repulsion, etc. Under these circumstances, the question which we had set ourselves to answer naturally remained unanswered. The observers did their best, under the instructions given; but the method, as we must think, showed itself inadequate.

We add that all three observers later changed their opinions, and declared for the independent status of the affective qualities. And this change was due, in some part, to the work by the present method. G, for instance, was struck by the objective immediacy of the affective coloring of certain smells and touches; his reflective distinction could not always be carried through. P was impressed by the fact, made known to him at the conclusion of the experiments, that the same smell might appear in his records now as pleasant and now as

unpleasant. While, however, the method of single stimuli may be credited with the impulse to this change of view, it can hardly be credited with more. The change of view was by no means completed when the experiments were given up for the series described in Section I, and we have no reason to believe that the method would have availed to complete it within any reasonable time. The main value of the work—with a single exception to be mentioned later—lay in the practice it afforded for introspection of what were oftentimes vividly affective consciousness.

The remaining observer, Wb, manifested no special interest in affective problems. He had, however, a very strong recognitive tendency, which our instructions failed to inhibit. Wherever possible, he sought to identify the perception; and where this was impossible he turned his attention to a characterization of the stimulus in terms of intensity, duration and associated ideas. No doubt, the recognitive habit would have been broken up in time; but Wb was unfortunately called away from the laboratory in December. We should not, in any event, have continued work with the method of single stimuli, as the three months of practice had no such appreciable effect upon Wb as we observed in the cases of W, G and P.

The one positive result obtained from these experiments has to do with the time-relations of the arousal of sensation and affection. Wundt has recently maintained that the affective process may enter consciousness alone, as the herald of the sensory process with which it is connected.[1] Our results, so far as they go, definitely negative this doctrine. The following table speaks for itself.

			Simultaneity	Sensation first	Affection first
P	Touch	144 obs.	38	106	0
	Odors	144	111	29	1?
G	Touch	72	28	43	1?
	Odors	72	27	27	0
W	Touch	48	16	32	0
	Odors	48	26	21	0
Wb	Touch	96	10	86	0
	Odors	96	57	36	0

The discrepancies between the number of observations and the number of recorded judgments for 'odors' are due to the

[1] Grundriss, 1905, 262 (Engl., 1907, 243); *cf.* Ladd, *Psychology, Descriptive and Explanatory*, 1894, 181.

fact that the stinging, pricking character of a smell sometimes overpowered its odor, and further, in the case of G, to a temporary catarrhal condition which led to a number of reports of 'no smell'. It seems best to omit all observations to which this report was attached, though it is right to say that the pricking sensations always came with or before the associated unpleasantness.

Here, then, are 695 observations, in which there are only two, and those doubtful references to a temporal procedence of affective process. G's touch record (rubber sheeting) read simply "the most pleasant": nothing was said of the smoothness, softness or elasticity which is mentioned in the remaining five observations on the same substance. It seems clear, however, that the judgment was comparative, implying the presence in consciousness of ideas of stimuli previously presented; so that the independent appearance of the affection is not made out. P's odor record (valerianic acid) consisted of the single word "awful!" Here again there is no positive evidence that unpleasantness only, and not an unpleasant odor, was dominating consciousness.[1] On the whole, then, the results speak strongly for simultaneity or for the succession sensation-affection. Either the affection appears distinctly later than the perception, or the two factors are in James' phrase, "beaten up together in one consciousness."[2]

We had anticipated that the cutaneous stimuli would, in the main, set up typical perceptual consciousnesses, and the odors typical affective consciousnesses, although we chose the stimuli with the view of securing both types of consciousness within each sense-department. The anticipation is in so far fulfilled as that, with all four observers, the touch-experiments show a marked preponderance of sequence (sensation first) over simultaneity. Only P's results show, for odors, a similar marked preponderance of simultaneity. This may perhaps be due to P's theoretical attitude to the affective problem, which was, as we have seen, different from that of the remaining three observers. However, the observations are too few to allow of safe inference. Our excuse for their small number is the well-known duration of smell adaptation: we never succeeded in taking more than 12 observations with odors during an experimental hour, and this maximum was but seldom attained.

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[1] It should be remarked that these reports are unusually brief, though (as the observers were instructed to give the immediate conscious reaction on the stimuli, and to disregard later reflection or association) the introspections rarely exceeded half-a-dozen descriptive terms.

[2] Psychological Review, i, 1894, 523 f.

III. Incidental Results of the Foregoing Experiments

Some of the incidental results of the experiments described in the preceding Sections have a bearing upon vexed questions of affective psychology. We now proceed to report them.

(*a*) *Qualitative Differences within P-U.* It is still a matter of controversy whether pleasantness and unpleasantness are the names of single affective qualities, or whether they are collective terms, covering a greater or less number of such qualities. Only one of our observers, W, finds anything like a qualitative differentiation. The remaining observers never reported differences of quality during the experiments, and when questioned on the matter, afterwards, they affirmed that they had found no evidence whatsoever for more than the single qualities, pleasantness and unpleasantness.

W's records for tones are as follow.

I found 94 very hard to compare, because the kinds of unpleasantness were so different. They [the tones] were both unpleasant: the first one caused strains, was thin and shrill; the other was deep and rough, and caused a sort of shudder.—Record X.

I don't know what makes the jarring sensations unpleasant. But I know that we are not speaking of the same thing when we speak of a jarring sensation being unpleasant as when we speak of the ominousness of a tone being unpleasant.—Record XII.

It was hard to say which I minded most, the melancholy mood or the ear strains; they did not seem comparable, but on the whole the strains seemed worse.—Record XV.

In 79 I noted the different unpleasantnesses of a shrill tone giving strain around ear and of a rough tone causing unpleasant vibrations of drum and nasal parts.—Record XVIII.

I noted a great variety of ways of being unpleasant through vibrations in ear and nose.—Record XXI.

Similar reports upon colors will be found under (*d*) below. When asked to comment on these records, at the conclusion of the experiments, W wrote: "I do not believe that I get any affective quality without obtrusive, though hardly analysable, organic sensation; the whole is inextricably blended, appearing as simple as a mood. My liking of red is (as I have said) altogether different from my liking of the color of a hepatica. With red I am excited and satisfied at once (whatever that means in terms of organic sensation; sensations of tingling come, from face and chest muscles especially). The blue-lavender color excites me in a different way: I have an expansion of the chest, with deep breathing, and an unsatisfied feeling: the emotion of 'longing' comes as near to this as I can describe, though the two feelings are not identifiable. I believe that I ought to say, on reconsideration, that the judgments of qualitative difference in affective quality refer always to this kind of blend of affection with (only very partially ana-

lysable) organic sensation. The organic sensations are very lively in me." It is, then, quite possible and even probable that the qualitative differences in question are sensational and not affective in their nature.

(*b*) *Mixed Feelings.* W is again the only observer who reports a mixed feeling, that is, a simultaneity of pleasantness and unpleasantness. The remaining observers are strongly of the opinion that mixed feelings do not occur. The records are as follow.

One of those tones, though unpleasantly twangy, had an associated idea of a bugle call to action, which was both pleasant and unpleasant, but was at least more satisfactory than the thin meaningless tone with which it was compared.—Record XXV.

There was something in the second tone of 162 that made it unpleasant, somewhat so, in spite of its sweetness; maybe a sort of prejudice against notes very high or very low.—Record XVII. The tone was g^8.

There were no similar reports upon colors. When asked to comment on these reports, at the conclusion of the experiments, W wrote: "I have never theorized or thought about mixed feelings; but I seem often to get them with tones, and I am surprised that they did not appear more frequently in the experiments. You must remember that 'feeling' to me means a blend of pleasantness or unpleasantness with organic sensations. It is possible that some of the organic sensations set up by the tones were pleasant, and some unpleasant, and that in recalling the experience I gave as simultaneous what was not so in reality. I cannot now say, and I do not think that (at any rate with an observer of my type) the method is suitable for settling the question." We had planned to make special experiments with W upon this and the previous point; but the observer was unexpectedly called away from the university, and we were therefore unable to do so.

(*c*) *Affective Localization.* A few cases of affective localization occurred in the experiments by the method of single stimuli.

G. Rubber membrane. The pleasantness seemed to be localized entirely in the finger-tips.
G. Carbolic acid. The affective tone seemed to be localized only in the mucous membrane.
P. Vanillin-coumarin. It seems as if the pleasantness is a separate sensation in the nose, different from the odor proper.
P. Valerianic acid. The unpleasantness seems to be localized in the upper part of the nose.

In three of these reports, the affection is plainly localized along with its sensation; consciousness has, to all intents and purposes, been narrowed down to a single sense-feeling (*cf.* Titchener, *Feeling and Attention*, 336). P's account of a sepa-

rate, sensation-like affection seems at first sight to imply a separate localization; but there can be little doubt that the localized pleasantness attached, in this case, to sensations aroused by stimulation of the trigeminal endings. P often reported, with the pleasant odors, tickling sensations in the nose which were themselves intrinsically pleasant; and, with the unpleasant odors, tickling or tingling sensations. These last blended with the quality of the odor into a unitary complex.

We add, finally, a brief account of (*d*) *individual differences in affective reaction to colors.* The colors employed were: VR tint 2, VR, VR shade 2, R, OR, RO, O, YO shade 1, YO, OY tint 1, OY, OY shade 1, Y, GY, YG, G, BG shade 2, BG, BG tint 2, GB, GB shade 1, B, VB, BV, V, RV. The reactions of the observer G may be summed up as a preference for highly saturated colors that are not too bright, a special dislike for browns of low saturation, and a decided liking for YG. The dislike of little saturated browns was mentioned by the observer; he was not aware of his liking for the YG. Towards the end of the experiments, however, he reports: "The YG was strikingly unpleasant this time, though I remember having preferred it in other combinations." The reactions of the observer W are more differentiated, and appear to be worth a report in full.

Violet red, orange red, and violet blue. I find reds that I like in quite a different way from the violet and blue alone. I don't know whether there is a common element in the way I like all these colors, but I think there is in the way I like the red and the violet, though there is a difference too. The violet has a lighter, giddier, more exciting effect. The red seems merely to affect the retinas more.

Violet red, shade 2. The dull color in 157 seemed restful because of its dullness as well as pleasant in itself. I think there were two elements there, one affective and one organic from eye muscles relaxing or else pleasant to retina itself.

Red (the red is rather dark due to the oxidation of the pigment.)—There came in a faint associated idea that I did not like dark red dresses; it did not, however, make me dislike the dark red. And yet there was no active liking of it; it merely did not trouble me; my eye could rest on it easily; it was dark and faintly restful.

Orange red, red orange, orange, orange yellow, yellow green and blue green. The oranges were irritating and aggressive; the orange yellow was felt clear, pure and restful by comparison with the oranges.

The sort of disagreeableness from the bright oranges is different from that of the blue green or yellow green; the one antagonizes (fights) me and the other disgusts me.

A brighter yellow I did not like at all. I do not like the glare of the bright colors; they almost hurt my eyes.

Orange yellow, green yellow, and red violet. I cannot get anything but a feeling of disgust to those I really dislike, like that green yellow in 100; while the bright clear colors like the orange yellow caused no disgust; they only tired me, and I said the word "crude" with them, they seemed raw and rasping. They gave me a restless feeling of being on edge.

The red violet I disliked most and the green yellow was most disgusting. I know the difference in the feeling, but I cannot analyze it. The disgust was accompanied by movements in the chest and facial muscles, and a sort of dropping feeling. The dislike was more aggressive and the color seemed more aggressive.

Green blue and blue. The green blue in 22 brought a distinct sense of relief; especially when I looked at it from the yellow green.

In 180 there was no dislike to the blue, but a positive feeling of discomfort in the presence to my eyes of such a raw color (lacking gray or white).

Blue violet, and green blue shade 1. At the blue violet in 73 I was conscious of saying "ah" on a long breath, and I think I relaxed all over; I did something all over and it was not a start up. I think I had a typically pleasant feeling there; it was very absorbing and left no room for thinking anything; it was a feeling half of wonder and half of "ah, that's good," and my eyes felt as if they rested on the color and never wanted to leave it. I think there were breathing sensations, and it left a kind of hunger for more which I think was in the chest.

I liked both the colors in 203 and they seemed to present two different kinds of pleasantness. The green blue was restful and satisfactory, altogether good to look at, but unexciting. The violet was exciting. As I looked from the one to the other I felt a distinct change, a lift of the chest, I think, and tightening of facial muscles, and a catch in the inspiration when looking at the violet. There was more than this; a tickling feeling in chest; and besides these bodily feelings there was something else too.

Violet and red violet. In No. 76 I seemed to have succeeded in the discovery of the pleasantly affective attitude. It seemed to me the attitude was nearly that of attention; eyes seemed fixed to the spot and straining out of head; body seemed alert, breath drawn in with a little almost tickling sensation at bottom of chest; all this plus something which I cannot analyze, a sort of buoyant feeling. No crowding in of associations or thoughts that I was aware of. I did like the violet when it came, and I seemed to still expect to like the color in 77, for when 77 (blue vs. red violet) came, I had a feeling of disappointment, a let-down feeling and turning away of the head. I am not sure but that there were muscular contractions in throat as if to spit it out. I am sure there was a general movement of backing off, with turning of head away,

Red violet, and yellow orange shade 1. I got a distinctly unpleasantly affective quality in 85, but when I tried to analyze it only got quivery sensations running up and down my arms and legs. There was a strong disgust for both and it seemed exactly the same in the l. (yellow orange) as in the r. (red violet), although I had no prejudice in regard to the orange. And it seemed intensified as I tried to bring them in at one glance. I think there were feelings in the chest of contraction.

General observations on the affective values of the various colors. The clear, not too bright yellow gives a light feeling; I think it is an idea; an idea of lifting up and lightness; not an actual lifting of the chest and head, but these may be there. I think the eyes open wide, and you feel as if you could look through it; it is exciting, and quite different from the dull blue which is also pleasant. You want to look straight at the blue; it is commonplace but nice. The bright red, again, is pleasant in a different way; it is exciting, but not like the yellow. It is a little aggressive, and you don't want to look at it too long, or look through it. You could not bear to imagine the air red,

but you could stand the air that clear yellow for a little while. The blue violet is exciting, again, but something is added; more organic sensations, and you want to live in it. The pale blue and pale yellow are again pleasant in a different way, but I cannot analyze this at all. The dark green and dark purple red are pleasant, more as the dark blue is, but there is an exciting element in the dark purple red. I should say that the dark purple red, the dark green, the dark blue, the pale blue, and the pale yellow excite æsthetic feelings; this seems to be due largely to the mixture of white and gray. Yet I do not find it in the pink.

Disagreeable blue greens and pink reds and yellow green have an affective quality, which is almost distinct enough to be a sensation; I don't know whether it follows on organic sensations or not. It seems to pierce you; to do something to you and to be very positive.

IV. The Discriminative Reaction

Two methods are at hand for the investigation of the time-relations of sensation and affection. There is, first, the graphic method, in which the observer may register the moment of appearance of the sensory or affective process. The writer made a series of experiments with a simple form of this method in the Harvard Laboratory in the year 1906-1907: the stimuli employed were colors, geometrical figures, and illustrative photographic pictures, and the result was that the affection set in noticeably later than its sensation. These experiments will be reported in a later paper. There is, secondly, the method of reaction. We took, during the months of December, 1907, to April, 1908, a series of discriminative reactions to cutaneous stimuli, which are now to be described. Discriminative reactions to odors were also planned, but for lack of time have not been carried out.

We selected five pairs of stimuli, with the characters: hard, soft; rough, smooth; sharp, blunt; wet, dry; hot, cold. Wooden blocks, 3 by 2 by 1 in., having a slightly raised rim, were used to hold the stimulating surfaces. For *hard* we inserted in the block a plate of sheet brass; for *soft*, a layer of cotton wool; for *rough*, coarse sandpaper; for *smooth*, a sheet of kid leather; for *sharp*, an even field of short tacks, point up (the points were slightly blunted, in order to avoid injury to the finger); for *blunt*, an even field of furniture tacks, head up; for *wet*, water-soaked cotton wool; for *cold*, a sheet of brass cooled in ice-water; for *hot*, a sheet of thicker brass heated to about 50° C. For *dry* we employed the smooth surface of the wooden block itself. The reactions were taken by means of the vernier chronoscope, model II.[1] The stimulus block rested partly upon a support, placed on the table, and partly on the button of the release-key of the longer pendulum. The pressure upon the button was so slight as not to interfere

[1] E. C. Sanford: Improvements in the Vernier Chronoscope, this *Journal*, xii, 1901, 592.

with the working of the instrument. The observer sat with his left hand in a specially prepared rest, grasping the sides of the stimulus block by his thumb and middle finger. The forefinger thus extended over the stimulus surface; and the stimulus was applied (and the long pendulum released) by a single pawing movement of the finger-tip downwards. The forefinger of the right hand rested, of course, upon the button of the release-key of the shorter pendulum.

The observer was given general directions for the performance of the discrimination reaction[1] to the characters hard-soft, rough-smooth, wet-dry, hot-cold, sharp-blunt, pleasant-unpleasant. In the actual experiment, the experimenter would say, for instance: "Hot or cold? Ready!" whereupon the observer would close his eyes, and adjust his two hands to the instrument. As soon as the observer was in position, the experimenter called "Now!" The observer then made the movement with the forefinger of his left hand which gave the stimulus and started the longer pendulum, and after discrimination of the character of the stimulus pressed the key of the shorter pendulum with the forefinger of his right hand. The experimenter counted off the swings of the two pendulums in the usual way.

Preliminary experiments made by the writer and Professor Titchener led us to believe that the necessary manipulations would readily be learned by the observers. As all had had practice in the ordinary reaction experiment, we planned to continue their special practice only to the point at which a set of 25 reactions could be made without error; and we expected that this point would be reached in three or four hours. We were over-sanguine. In all cases, the preliminary practice covered a period of several weeks; and in the case of R, W and C an errorless series could not be obtained at all, and we were forced to rest content with what appeared to be an irreducible minimum of mistakes (too light pressure upon the one or the other key, confusion of the tasks of the two hands). The number of these wrong reactions is shown in the Tables.

The observers were Mr. Geissler, Mr. Pyle, Miss M. G. Rand (R), Miss A. T. Waldie (W), and Mr. W. D. Clark (C). The three last had had two years of laboratory training in psychology. A complete set of experiments comprised 50 stimuli, 30 of which were presented for sensible and 20 for affective discrimination. Great care was taken to distribute the ten surfaces evenly, and to utilize them all in the affective work. The 50 stimuli were so arranged that the same surface was never presented twice in succession, for the two kinds of reaction; and the order of presentation was reversed from set

[1] E. B. Titchener: Exp. Psychol., II, i, 1905, 186 f.

to set. A half-set, of 25 reactions, was taken in the experimental hour.

Tables I and II give the results of 350 reaction-times obtained from the observers G and P; 210 times of sensible, and 140 of affective discrimination for each observer.

TABLE I

Observer G. Unit, 1/50 sec.

	Affective discrimination times						Sensible discrimination times					
Stimulus	Range	Median	MV	Average	MV	Wrong	Range	Median	MV	Average	MV	Wrong
Hard	74-88	80	5.3	80	5.5	0	50-58	54	2.8	55	3.1	0
Soft	56-88	70	10.1	72	11.0	0	34-48	42	3.0	41	3.0	0
Rough	62-86	79	6.9	77	7.5	0	54-76	66	5.1	65	4.9	0
Smooth	76-96	81	4.9	83	4.7	0	54-78	66	6.1	67	6.0	0
Sharp	32-50	40	6.4	43	7.3	1	28-38	34	4.1	35	4.6	2
Blunt	54-86	70	9.2	69	9.7	0	44-58	51	4.5	50	4.7	0
Wet	54-82	71	8.5	69	8.6	0	46-62	55	4.7	53	4.5	0
Dry	80-99	86	6.0	85	5.3	0	54-70	64	4.5	61	4.1	0
Warm	54-82	79	8.7	73	8.6	2	54-86	74	6.1	74	6.3	0
Cold	78-88	85	7.6	84	8.2	0	54-83	71	5.3	67	5.8	0

TABLE II

Observer P. Unit, 1/50 sec.

	Affective discrimination times						Sensible discrimination times					
Stimulus	Range	Median	MV	Average	MV	Wrong	Range	Median	MV	Average	MV	Wrong
Hard	72-86	81	4.6	82	4.4	1	52-72	60	6.4	61	6.8	0
Soft	58-72	62	6.2	64	6.0	1	38-50	42	3.8	44	3.8	0
Rough	80-108	93	12.0	96	12.0	1	50-68	58	5.2	58	5.2	0
Smooth	60-86	73	6.7	73	6.7	0	48-68	53	4.8	55	5.7	0
Sharp	52-64	55	6.0	57	4.7	0	38-48	40	4.1	42	4.0	1
Blunt	84-94	91	14.0	90	14.0	1	46-62	59	5.0	56	4.8	0
Wet	74-86	82	8.0	81	7.0	0	56-76	68	4.9	67	4.5	0
Dry	70-78	80	4.5	75	2.3	1	62-82	73	5.8	75	6.8	0
Warm	71-98	84	7.0	82	6.5	0	70-86	76	4.7	77	4.5	0
Cold	80-100	91	8.5	89	7.7	0	78-94	86	5.3	87	4.3	0

Inspection of these tables shows that the affective discrimination times are uniformly longer than the sensible discrimination times. In general, also, as might have been anticipated, the *MV* of the affective reactions is larger than the *MV* of the sensory; exceptions occur only for *G* with the stimulus *smooth*,

and for *P* with the stimuli *hard* and *dry*. Nevertheless, the *MV* of the affective reactions is by no means abnormally large. And it can hardly be doubted that the affective times represent the observers' discriminative reactions in precisely the same way as the sensory times. The individual ranges are of the same order; and the total range of the sensory times, from 28 with *sharp* to 86 with *warm* for *G*, and from 38 with *sharp* to 94 with *cold* for P, are paralleled by the affective limits 32 (unpleasant) and 99 (pleasant) for the former, and 52 (unpleasant) and 108 (unpleasant) for the latter observer. The Tables, therefore, seem to show conclusively that the affective processes are amenable to the reaction method.

The observer P discriminated the *warm* stimulus sometimes as warm, and sometimes as hot. The average times are:

	Warm	Hot
Sensory:	20 reactions: 78±4.5	20 reactions: 98±7.1
Affective:	15 reactions: 80±6.0	15 reactions: 108±8.0

It would, of course, have been exceedingly difficult, in an experiment like ours, to keep the temperature of the stimulus constant; and beside taking an initial test and carefully regulating the time-relations of the experiments, we made no effort to do so. In so far, then, as these figures depend upon objective differences in the temperature of the stimulus, they are in agreement with Thunberg's statement that the simple reaction-time of heat is longer than that of warmth (*Zeits. f. Psychol.*, xlvii, 1908, 166 ff.). There were a few cases, however, when the effect of the stimulus was not simply warmth or heat, but when the sensory experience began with a warmth, which quickly passed over into heat. In these cases the observer might react at once to the warmth, or might wait for the development of the perception of heat; and the times naturally varied in accordance with his attitude.

The following Tables III-V show the results obtained with the three other observers.

TABLE III

Observer R. Unit, 1/50 sec.

	Affective discrimination times						Sensible discrimination times					
Stimulus	Range	Median	MV	Average	MV	Wrong	Range	Median	MV	Average	MV	Wrong
Hard	34-40	36	2.7	37	2.8	1	28-40	32	3.0	34	3.0	1
Soft	34-51	42	2.5	41	3.0	3	28-44	34	1.3	34	1.7	1
Rough	32-60	39	4.1	40	4.1	2	26-50	36	2.8	37	2.3	2
Smooth	36-55	44	3.5	43	3.5	1	30-46	40	2.8	38	3.0	1
Sharp	29-43	32	2.5	32	2.5	4	26-36	30	2.0	31	2.0	3
Blunt	32-44	36	3.3	37	3.4	2	24-30	28	1.4	28	1.4	1
Wet	32-53	40	3.2	38	3.6	2	30-48	32	2.1	36	1.8	1
Dry	38-48	40	3.5	43	3.5	1	30-44	34	3.3	35	3.4	2
Warm	34-55	40	3.2	41	3.8	2	32-46	40	3.0	39	3.0	1
Cold	46-74	52	4.1	50	4.0	1	30-47	40	2.4	41	2.5	1

TABLE IV

Observer W. Unit, 1/50 sec.

Stimulus	Affective discrimination times						Sensible discrimination times					
	Range	Median	MV	Average	MV	Wrong	Range	Median	MV	Average	MV	Wrong
Hard	44-60	48	4.3	48	5.1	2	30-44	36	4.0	38	4.6	1
Soft	48-66	58	4.8	59	5.3	6	28-38	34	2.0	34	2.0	5
Rough	26-50	46	5.6	43	6.6	5	28-44	32	3.5	34	3.5	4
Smooth	32-48	44	3.2	42	4.4	4	22-34	30	1.8	31	2.0	3
Sharp	34-50	38	5.5	40	5.0	6	26-34	29	2.7	30	3.0	6
Blunt	38-60	42	8.1	49	7.0	2	34-48	38	4.5	41	4.5	2
Wet	36-54	46	6.1	47	6.1	3	30-46	38	4.0	39	4.2	2
Dry	38-60	46	4.8	44	5.0	4	30-46	44	6.6	39	7.6	4
Warm	42-69	54	9.0	55	9.4	2	38-60	50	7.0	49	6.4	4
Cold	42-62	58	8.8	59	9.2	2	40-44	42	2.1	43	2.1	2

TABLE V

Observer C. Unit, 1/50 sec.

Stimulus	Affective discrimination times						Sensible discrimination times					
	Range	Median	MV	Average	MV	Wrong	Range	Median	MV	Average	MV	Wrong
Hard	84-130	99	15.0	108	12.7	3	40-70	54	6.7	55	6.8	1
Soft	54-108	82	22.0	85	17.4	3	46-66	58	5.0	56	5.1	2
Rough	66-150	84	28.0	106	21.3	3	58-90	68	9.4	69	9.0	5
Smooth	86-102	81	6.4	89	4.0	2	58-66	60	2.3	62	2.6	2
Sharp	58-114	76	15.0	80	15.0	2	32-54	50	5.6	46	6.0	4
Blunt	54-106	84	28.8	103	28.4	4	48-72	60	7.0	60	7.0	3
Wet	66-98	80	9.9	81	11.2	2	52-74	62	6.9	60	7.4	2
Dry	98-148	90	9.1	94	9.5	4	46-60	52	4.0	54	3.6	2
Warm	84-108	89	9.8	88	9.0	3	74-94	81	4.8	84	4.5	2
Cold	82-152	84	18.0	103	18.6	1	62-90	79	7.7	77	8.3	2

The general results are the same as those of Tables I and II. In all three Tables, however, there are many more 'wrong' reactions than we obtained with G and P; it must be remembered that these two observers had had prolonged special practice in work upon the affective processes, while R, W and C were new both to the problem and to the particular method of reaction. It is striking that the absolute times given by C obviously fall into the same class as those of G and P, while the times given by the two woman-observers R and W are, throughout, shorter. Thus, if we average the averages, for the sake of a rough comparison, we find:

	Sensory	Affective
G	56.8	73.5
P	62.2	78.9
C	62.3	93.7
R	35.3	40.2
W	37.8	52.2

There was no difference, that we could discover, in the nature of the 'wrong' reactions as given by C on the one hand and R and W on the other; practically all of these reactions were due to the observer's omission to move his finger down upon the stimulus, or to his making the touch upon the stimulus surface so light that the pendulum was not released. The sole point of difference that we could find was this: that C took the difficulties of manipulation easily and in a matter of course way, whereas R and W were a little afraid of the apparatus, and braced themselves anxiously for its management. It is possible, then, that they hurried over the reaction, and made it cognitive rather than discriminative. The time required for the cognition of a color is, for instance, considerably less than that required for the discrimination of two colors (Wundt, *Phys. Psych.*, iii, 1903, 456, 458). If this interpretation is correct, we have shown, though unintentionally, that the cognitive as well as the discriminative reaction may be applied to the affective processes. We had required no introspections during the course of the experiments; the observers were simply asked to follow to the best of their ability the instructions given. When questioned at the end of the work, however, and when confronted with a careful analysis of the cognitive and the discriminative attitudes, R and W inclined to the view that they had, in fact, reacted cognitively. At all events, the important thing is that the affective averages are without exception the larger.

The stimuli *hard* and *dry*, which in the sensible discriminations were contrasted with *soft* and *wet* were apprehended by all observers in the affective discriminations as *smooth*. Since this change in apprehension destroyed the parallelism of the two halves of our Tables, we made some additional experiments (21 valid reactions with P and G, and 18 with R, W and C) in which these stimuli were contrasted with a *rough*. The results are shown in the following Table.

DISCRIMINATIVE REACTIONS TO SMOOTH

Observer	Stimulus	Range	Median	MV	Average	MV
G	Hard	52-64	60	4.7	59	5.4
	Dry	50-64	58	4.2	60	4.8
P	Hard	44-54	50	4.1	47	4.9
	Dry	46-58	50	4.8	51	6.2
R	Hard	32-40	36	2.8	37	2.8
	Dry	35-44	38	1.7	39	2.8
W	Hard	41-56	45	4.3	46	4.0
	Dry	36-52	44	5.0	43	5.0
C	Hard	57-71	65	3.1	63	3.0
	Dry	55-71	62	3.1	60	2.5

If we compare these times, first, with the times for *smooth* in the preceding Tables, we observe that G and P show a slight shortening, presumably due to practice; R and C give practically the same values as before; W gives a somewhat longer reaction, due (in her own belief) to the persistence of the connection between 'smooth' and the kid-leather feeling of the earlier series. If, secondly, we substitute them in the previous Tables for the sensible discrimination times under the headings *hard* and *dry*, we find that the difference between the two types of reaction is somewhat lessened for *hard* in the cases of G, W and C, lessened to o in the case of R, and somewhat increased in the case of P; while the difference for *dry* is somewhat lessened in the cases of R and C, increased in that of P, and left unchanged in those of G and W. It is, of course, entirely possible that affective reactions, had they been introduced into this supplementary series, would again have given uniformly longer times.

On the general question of the time-relations of sensory and affective arousal, two opinions are *a priori* possible. Since feeling is readily and regularly 'expressed' in movement, it might be maintained that the movement which registers the appearance of an affective process in consciousness should occur at least as quickly as that which indicates the appearance of a sensation. Since, on the other hand, affection lacks the attribute of clearness, it might be maintained that a longer time must elapse than in the case of sensation before the movement of response is made. The experiments performed in the Harvard laboratory tell directly, those just described tell indirectly, for the second hypothesis. Or at any rate they show that, whether the reaction movement itself be performed more quickly or more slowly, the formation of an affective consciousness requires a longer time than that of a sensory consciousness.

A full discussion of the question would here, where we are dealing only with indirect evidence, be out of place; it will be given in a later paper. What we have proved in the present Section is that the method of reaction is applicable to the affective processes pleasantness and unpleasantness. The affective discrimination times are, as we have said, times of the same general order, and show the same sort of variability, as the sensible discrimination times. It remains only to add that there was no single case, in the reaction experiments, when the affection appeared first in consciousness, as the herald of the connected sensory quality (*cf.* pp. 181 f. above). Whenever the observer reacted to affection, he reacted to a pleasant or unpleasant cutaneous perception.